



Designation: C476 – 23

## Standard Specification for Grout for Masonry<sup>1</sup>

This standard is issued under the fixed designation C476; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

*This standard has been approved for use by agencies of the U.S. Department of Defense.*

### 1. Scope<sup>\*</sup>

1.1 This specification covers two types of grout, fine and coarse grout, for use in the construction of masonry structures. Each type (fine and coarse) is further classified as conventional grout (requiring mechanical consolidation by puddling or vibration when placed) and self-consolidating grout (not requiring mechanical consolidation when placed). Conventional grout is specified by (1) proportions or (2) strength requirements. Self-consolidating grout is specified by strength requirements.

1.2 The text of this specification references notes and footnotes that provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of this specification.

1.3 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

### 2. Referenced Documents

#### 2.1 ASTM Standards:<sup>2</sup>

- C5 Specification for Quicklime for Structural Purposes
- C29/C29M Test Method for Bulk Density (“Unit Weight”) and Voids in Aggregate
- C143/C143M Test Method for Slump of Hydraulic-Cement Concrete

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee C15 on Manufactured Masonry Units and is the direct responsibility of Subcommittee C15.30 on Specifications for Mortars and Grouts.

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For Annual Book of ASTM Standards volume information, refer to the standard’s Document Summary page on the ASTM website.

C150/C150M Specification for Portland Cement

C207 Specification for Hydrated Lime for Masonry Purposes

C260/C260M Specification for Air-Entraining Admixtures for Concrete

C404 Specification for Aggregates for Masonry Grout

C494/C494M Specification for Chemical Admixtures for Concrete

C595/C595M Specification for Blended Hydraulic Cements

C618 Specification for Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete

C989/C989M Specification for Slag Cement for Use in Concrete and Mortars

C1019 Test Method for Sampling and Testing Grout for Masonry

C1157/C1157M Performance Specification for Hydraulic Cement

C1602/C1602M Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete

C1611/C1611M Test Method for Slump Flow of Self-Consolidating Concrete

### 3. Materials

3.1 Materials used as ingredients in grout shall conform to the requirements specified in 3.1.1 – 3.1.5.

3.1.1 *Cementitious Materials*—Cementitious materials shall conform to one of the following specifications:

3.1.1.1 *Portland Cement*—Type I, IA, II, IIA, III, and IIIA of Specification C150/C150M.

3.1.1.2 *Blended Cements*—Type IL, IS(<70), IP, IT(S<70), or blended cements with special properties designated by (A), (MS), or (HS), or a combination of (A) and (MS) or (HS), as appropriate, of Specification C595/C595M.

3.1.1.3 *Hydraulic Cements*—Types GU, HE, MS, or HS of Specification C1157/C1157M.

3.1.1.4 *Quicklime*—Specification C5.

3.1.1.5 *Hydrated Lime*—Type S of Specification C207.

3.1.1.6 *Coal Fly Ash or Raw Calcined Natural Pozzolan*—Specification C618. Grouts produced with blends of cement and fly ash or raw calcined natural pozzolan shall have the compressive strength specified (4.2.1.2 or 4.2.2.1).

3.1.1.7 *Granulated Blast Furnace Slag*—Specification C989/C989M. Grouts produced with blends of cement and

<sup>\*</sup>A Summary of Changes section appears at the end of this standard

**TABLE 1 Conventional Grout Proportions by Volume**

Type	Parts by Volume of Cement <sup>a</sup>	Parts by Volume of Hydrated Lime or Lime Putty	Aggregate, Measured in a Damp, Loose Condition	
			Fine	Coarse
Fine grout	1	0–1/4	2 1/4 –3 times the sum of the volumes of the cementitious materials	...
Coarse grout	1	0–1/4	2 1/4 –3 times the sum of the volumes of the cementitious materials	1–2 times the sum of the volumes of the cementitious materials

<sup>a</sup>Includes Specification C150/C150M, C595/C595M, and C1157/C1157M cements as described in 3.1.1.

granulated blast furnace slag shall have the compressive strength specified (4.2.1.2 or 4.2.2.1).

3.1.2 **Aggregates**—Aggregates shall conform to Specification C404.

3.1.3 **Water**—Water shall conform to Specification C1602/C1602M.

**NOTE 1**—Specification C1602/C1602M allows potable water to be used without testing. Other sources of water may be used if the water meets the requirements of Specification C1602/C1602M.

3.1.4 **Admixtures**—Integral waterproofing compounds, accelerators, or other admixtures not mentioned definitely in the specification shall not be used in grout for use in reinforced masonry without approval from the specifier.

**NOTE 2**—The specifier is usually the Licensed Design Professional.

3.1.4.1 **Air-Entraining Admixtures**—Air-entraining admixtures shall conform to Specification C260/C260M.

**NOTE 3**—If the grout is to be used to bond masonry units to reinforcing bars, the use of air-entraining materials or air-entraining admixtures is not recommended.

3.1.4.2 **Admixtures for Ready-Mixed Grout Transported to the Job Site**—Retarding admixtures conforming to Specification C494/C494M, Type B or D are permitted in ready-mixed grout transported to the job site if the grout meets the compressive strength and slump requirements of 4.2.1.2.

3.1.4.3 **Admixtures for Self-consolidating Grout**—High-range water-reducing admixtures conforming to Specification C494/C494M, Type F or G, and viscosity-modifying admixtures conforming to Specification C494/C494M, Type S, are permitted in self-consolidating grout.

**NOTE 4**—High-range water-reducing admixtures are best suited to achieve the water reduction and slump flow values required for self-consolidating grout. Admixture suppliers should be consulted to ensure that the particular high-range water-reducing admixture is suitable for self-consolidating grout.

**NOTE 5**—Viscosity-modifying admixtures may be used to enhance the stability of self-consolidating grout. The C494/C494M requirements for Type S (specific performance) admixtures provide a means of determining that the viscosity-modifying admixture will not have adverse effects on fresh, hardened and durability properties of the grout. Admixture suppliers should be consulted to ensure that the particular viscosity-modifying admixture is suitable for self-consolidating grout.

3.1.4.4 **Antifreeze Compounds**—No antifreeze liquids, salts, or other substances shall be used in grout to lower the freezing point.

3.1.5 **Storage of Materials**—Cementitious materials and aggregates shall be stored in such a manner as to prevent

deterioration or intrusion of foreign material or moisture. Any material that has become unsuitable for good construction shall not be used.

**NOTE 6**—If the grout is to be used to bond masonry units to reinforcing bars, the use of air-entraining materials or air-entraining admixtures is not recommended.

## 4. Grout Type and Proportions

4.1 **Type**—Grout type shall be specified as fine or coarse.

4.1.1 Fine grout shall be manufactured with fine aggregates.

4.1.2 Coarse grout shall be manufactured with a combination of coarse and fine aggregates.

**NOTE 7**—Building code provisions and grout space dimensions should be reviewed when selecting grout type or types.

4.2 **Proportions of Ingredients**—Proportions shall be determined as follows:

4.2.1 **Conventional Grout**—The grout shall be mixed to a slump of 8 to 11 in. (200 to 280 mm) as determined by Test Method C143/C143M. Proportions shall be determined by one of the following methods:

4.2.1.1 Requirements of Table 1.

4.2.1.2 **Specified Compressive Strength**—Proportions established by 28-day compressive strength tests in accordance with Test Method C1019 that equal or exceed the specified compressive strength. The grout shall have a minimum compressive strength of 2000 psi (14 MPa) at 28 days.

4.2.2 **Self-consolidating Grout**—Proportions shall be determined by the following method:

4.2.2.1 **Specified Compressive Strength**—Proportions established by 28-day compressive strength tests in accordance with Test Method C1019 that equal or exceed the specified compressive strength. The grout shall be mixed to a slump flow of 24 to 30 in. (610 to 760 mm) as determined by Test Method C1611/C1611M and shall have a Visual Stability Index (VSI) of not greater than 1 as determined by Appendix X1 of Test Method C1611/C1611M. The grout shall have a minimum compressive strength of 2000 psi (14 MPa) at 28 days.

**NOTE 8**—The value for  $T_{50}$  as described in Appendix X1.1 and Note X1.1 of Test Method C1611/C1611M is a property of self-consolidating concrete and can be used as an indicator of batch-to-batch quality, consistency and performance in-situ of self-consolidating grout. While there is no consensus as to the appropriate  $T_{50}$  for all self-consolidating grouts, average values from 1.5 to 4 sec, with variations of  $\pm 0.5$  sec from the average value, determined for the particular self-consolidating grout, typically provide proper viscosity and indicate batch-to-batch consistency.

**NOTE 9**—Building code provisions should be reviewed when selecting



the specified compressive strength of grout.

## 5. Measurement and Production

**5.1 Measurement of Materials**—Measure materials for grout such that the required proportions of the grout materials are controlled and accurately measured.

NOTE 10—When converting volume proportions to batch weights, use the following material bulk densities:

Material	Bulk Density, lb/ft <sup>3</sup> (kg/m <sup>3</sup> )
Portland cement	94 (1505)
Blended cement	Obtain from bag or supplier
Other cementitious materials	Obtain from bag or supplier
Hydrated lime	40 (640)
Lime putty <sup>a</sup>	80 (1280)
Sand, damp and loose	80 (1280) of dry sand
Coarse aggregate	Use Test Method C29/ C29M, Shoveling Method, to determine weight per cubic foot.

<sup>a</sup>All quicklime should be slaked in accordance with the manufacturer's directions. All quicklime putty, except pulverized quicklime putty, should be sieved through a No. 20 (850-µm) sieve and allowed to cool until it has reached a temperature of 80°F (26.7°C). Quicklime putty should weigh at least 80 lb/ft<sup>3</sup> (281 kg/m<sup>3</sup>). Putty that weighs less than this may be used in the proportion specifications if the required quantity of extra putty is added to meet the minimum weight requirements.

**5.2 Production Methods**—Grout shall be produced using one of the following procedures:

### 5.2.1 Grout Materials Mixed with Water at the Job Site:

#### 5.2.1.1 Conventional Grout:

(1) Individual cementitious materials and aggregates stored at the job site shall be mixed in a mechanical mixer for a minimum of 5 min with sufficient water to achieve the desired consistency.

(2) Individual ingredients transported to the job site in suitable compartments shall be mixed with water at the job site using continuous volumetric proportioning equipment to

achieve the desired consistency. Mix with an auger of appropriate length to provide adequate mixing.

(3) Factory pre-blended grout materials delivered to the job site shall be mixed in a mechanical batch mixer for a minimum of 5 min or in a continuous mixer following mixer manufacturer's recommendation with sufficient water to achieve the desired consistency.

NOTE 11—Conventional grout may be hand-mixed on small jobs with written approval of the mixing procedure by the specifier.

#### 5.2.1.2 Self-consolidating Grout:

(1) Individual ingredients transported to the job site as part of a self-consolidating grout manufacturer's system, shall be mixed at the job-site with water, per the manufacturer's recommendations, using continuous volumetric proportioning equipment to achieve the desired consistency. Mix with an auger of appropriate length to provide adequate mixing.

(2) Factory preblended grout materials delivered to the job site shall be mixed in a mechanical mixer with sufficient water, per the self-consolidating grout manufacturer's recommendation, to achieve the desired consistency.

(3) Job site proportioning and mixing of individual materials that are not part of a self-consolidating grout manufacturer's system shall not be permitted.

#### 5.2.2 Ready-Mixed Grout Transported to the Job Site:

**5.2.2.1 Conventional Grout**—Grout shall arrive at the job site in a ready-mixed condition. Slump shall be adjusted as necessary, and grout shall be re-mixed at mixing speed for at least 1 min before discharging to achieve the desired consistency.

**5.2.2.2 Self-consolidating Grout**—Grout shall arrive at the job-site in a ready-mixed condition. The addition of water at the job site is permitted in accordance with the self-consolidating grout manufacturer's recommendations.

## 6. Keywords

6.1 aggregates; cement; compressive strength; grout; masonry; portland cement; proportions ; self-consolidating grout

## SUMMARY OF CHANGES

Committee C12 has identified the location of selected changes to this standard since the last issue (C476 – 22) that may impact the use of this standard. (February 1, 2023)

(1) In subsections 3.1.1.6 and 3.1.1.7, deleted the sentence about “addition rates.” Also, deleted the word “portland” to recognize that C595 and C1157 cements, like C150 cement, can be blended with fly ash, natural pozzolans, or slag.

Committee C12 has identified the location of selected changes to this standard since the last issue (C476 – 20) that may impact the use of this standard. (September 1, 2022)

(1) Revised subsections of 4.2.

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